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Processing DORIS data with the GIPSY/OASIS 11 software for Precise Positioning and Orbit Determination: First results and Intercomparisons.

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in August 1992, the European lauch vehicle. Ariane put the TOPEX satellite on orbit, starting the French-American TOPEX/Poseidon oceanographic mission, For the first time, the precise tracking systems (I) ORIS, S1 ,R and GPS) were carried on-board the satellite in order to ensure the best possible orbit determination for the satellite.. This unique occasion provided several ways to test those systems between them, and especially to look for possible systematic hiss in the models or the data.

In order to intercompare results in terms of terrestrial reference frames and also to be able to look for possible biase between the GPS and the DORIS system, a collaboration between the Jet Propulsion 1.alml-story and the 1 nst it ut Geographique National was started. During this period, the J} 'I. GIPSY/OASIS 11 software, already known for its excellent performances within the IGS, was updated to be able to process Doppler data types such as 1)01{1S.

The aim of this paper is to briefly prc.sent this upgraded software and its major possibilities and mainly to present new results obtained by processing actual DORIS data with the GIPSY/OASIS 11 software (from present TOPEX and also previous and present S1'0"1'2 1)01<1S data). Three types of results were obtained: precise absolute. point positioning for the 1)01{1S ground stations, precise orbit determination for the TOPEX and S1'0'1'2 satellites, and finally, Earth rotation Parameters (polar motion).

in terms of point positioning, daily solutions were obtained using the so-ca lled "free network approach", already used successfully at JPL for GPS data processing. Several months of data were processed both for TOPEX and S} '01'2 data. The daily solutions show, for absolute point positioning, internal reputability around 10 cm level in latitude, 2(I cm in longitude and 20 cm in vertical. Weekly solutions were also formed to be able to improve these results by putting more DORIS data in the solution. '1'hose solutions were compared with the equivalent GPS solutions (GPS/IGS weekly solutions). Monthly solutions were also computed for both TOPEX and SPOT2 (alone or together) and compared with the ITRF'91 solution. Few centimeters agreements to the ITRF were shown in those monthly solutions. DORIS multi-satellites processing was also tested in order to estimate the scientific interest of a n]ulti-satellite 1)01{1S system for quick precise. point posit ioning.

For orbit positioning, the TOPEX orbit was stressed using the new JGM 1 gravity model and processing strategies, such as the one/revolution emprirical parameters. A special care was taken to try to detect systematic errors coming from imperfect modelling. Internal consitencies of the GIPSY/OASIS 11 DORIS orbits were tested using 30 hour arcs per "day" and looking at the (i-hour overlap every day. Internal consistency around 2 to 4 cm RMS in altittude was demonstrated, showing almost no biais from one orbit to another at the cm level. in order to look for potential bias, these orbits were also compared with the so-ca lled JPL GPS "reduced dynamic" orbits for which the data arc different, the models are different and also the processing stategies arc different (dynamic versus reduced dynamic orbit determination). in order to look for potential common error (due to the fact that we are using the. same software and the same. models) other tests were performed with other orbits computed from GPS, DORIS and/or S1 R data by other groups. A 3 to 7 cm agreement in altitude was shown in those comparisons. Another external check was also possible in the case of TOPEX, by looking carefully at the cross-over residuals from the different radar altimeters. Ail these tests confirmed that the DORIS orbit had a sub-decimetric precision and accuracy.

For systematic error detection, orbit compilation of the TOPEX satellite was performed by using both 1)01<1S and GPS data in a simultaneous adjustment (assuming same stations locations, using the local ties for the collocations; and same tropospheric zenith delays,...),

Finally, by processing DORIS data with the GIPSY/OASIS 11 software, it was also possible. to determine Earth rotation parameters such as polar motion at better than 1 to 2 mas (RMS) with daily estimations. Other stategies were also used, combining several days solutions or using two satellites simultaneously in the same computation (TOPEX and SPOT2) in order to look for' the potential improvements.

In conclusion, the TOPEX opportunity to test and combine DORIS and GPS proved to be a very intructive experience. New results were obtained with the DORIS system, both for point positioning and orbit determination.